**CLAIMS**

1. An integrated connection admission control (CAC) and bandwidth on demand control (BoD) system for allocating the resource of a common medium uplink of a multiple access (MA) asynchronous network segment, wherein:

the CAC comprises means for allocating static resource to all virtual connections (VCs) or groupings of VCs accepted by the CAC and means for booking dynamic resource to the VCs or groupings of VCs that require guaranteed dynamic resource, and

the BoD comprises means for allocating dynamic resource to VCs or to groupings of VCs requesting dynamic resource in such a way that all VCs or groupings of VCs requesting dynamic resource are dynamically allocated requested dynamic resource up to at least the guaranteed dynamic resource which has been booked for them by the CAC.2. A system according to claim 1 wherein the groupings of VCs are within the same subscriber access unit (SAU) or terminal.

3. A system according to claim 1 wherein the means for allocating static resource in the CAC allocates static resource to a VC when a VC is set up for the duration of the connection associated with the VC.

4. A system according to claim 1 wherein the means for booking dynamic resource in the CAC reserves booked dynamic resource to a VC when a VC is set up for the duration of the connection associated with the VC.

5. A system according to claim 1 wherein the means for allocating static resource in the CAC allocates static resource to a group of VCs and changes the amount of static resource allocated to a group of VCs when

new connections are set up or connections are released within the group.

6. A system according to claim 1 wherein the means for booking dynamic resource in the CAC books dynamic resource to a group of VCs and changes the amount of booked resource allocated to a group of VCs when new connections are set up or connections are released within the group.

7. A system according claim 1 wherein the CAC comprises means for accepting a VC j requiring a static resource of $SR_j$ and a booked dynamic resource of $BR_j$ when;

$$SR_j + BR_j + \sum_{k=1}^{K} SR_k + \sum_{k=1}^{K} BR_k \leq C_T$$

where $C_T$ is the total resource capacity of the common medium uplink and there are K existing VCs using the uplink and each of the K VCs have been reserved static resource $SR_k$ and booked dynamic resource $BR_k$ by the CAC.8. A system according to claim 1 wherein the CAC comprises means for accepting a VC j requiring a static resource of $SR_j$ and a booked resource of $BR_j$ when;

$$SR_j + BR_j + \sum_{k=1}^{m} SR_k + \sum_{k=1}^{m} BR_k \leq C_{SAU}$$

where $C_{SAU}$ is the maximum rate available to a subscriber access unit (SAU) or terminal and there are m existing VCs (VC k for k=1,..., m) in the SAU or terminal and each VC k has static resource $SR_k$ and booked dynamic resource $BR_k$ reserved to them by the CAC.

9. A system according to claim 1 wherein the means for allocating static resource in the CAC allocates static resource and the means for

allocating dynamic resource in the BoD allocates dynamic resource on a periodic basis.

10. A system according to claim 1 wherein the means for allocating static resource in the CAC allocates static resource and the means for allocating dynamic resource in the BoD allocates dynamic resource on a periodic basis and during a current period the means for allocating static resource in the CAC allocates resource for new VCs and de-allocates resource from released VCs for the next period and the means for allocating dynamic resource in the BoD allocates dynamic resource for the next period to VCs or groups of VCs requesting dynamic resource for the next period.

11. A system according to claim 1 wherein the means for allocating static resource in the CAC and the means for allocating dynamic resource in the BoD allocate resource on a periodic basis and the allocations made by the BoD for the next period are independent of the allocations made by the BoD for the current period.

12. A system according to claim 1 wherein the means for allocating static resource in the CAC and the means for allocating dynamic resource in the BoD allocate resource on a periodic basis and the allocations made by the BoD for the next period are dependent on the allocations made by the BoD for the current period.

13. An integrated connection admission control (CAC) and bandwidth on demand control (BoD) system for allocating the resource of a common medium uplink of a multiple access (MA) asynchronous network segment, wherein:

the CAC comprises means for allocating static resource to all virtual connections (VCs) or groupings of VCs accepted by the CAC and means for booking dynamic resource to the

VCs or groupings of VCs that require guaranteed dynamic resource, and

the BoD comprises means for allocating dynamic resource to VCs or to groupings of VCs requesting dynamic resource according to the following rules;

when the requested resource from the VC or group of VCs is less than or equal to the booked dynamic resource for the VC or group of VCs, the BoD allocates the VC or group of VCs all of the requested resource,

when the requested resource from the VC or group of VCs is greater than the booked dynamic resource for the VC or group of VCs, the BoD allocates the VC or group of VCs the booked dynamic resource and additionally the BoD allocates the VC or group of VCs a share of the remainder of the requested resource, from the remaining resource capacity of the common medium uplink.

14. A system according to claim 13 wherein the means for allocating dynamic resource in the BoD allocates the share of the remainder of the requested resource, referred to herein as the best effort resource, BE, for each VC or group of VCs, by maximising the sum of the natural logarithms of all the BEs, subject to the conditions that;

the BE allocated to each VC or group of VCs is less than or equal to the remainder of the requested resource for that VC or group of VCs, and

the sum of all the allocated BEs is less than or equal to the remaining resource capacity of the common medium uplink.

15. A system according to claim 13 wherein the means for allocating dynamic resource in the BoD allocates the share of the remainder of the requested resource, referred to herein as the best effort resource, BE,

for each VC or group of VCs, by maximising the product of all the BEs, subject to the conditions that;

the BE allocated to each VC or group of VCs is less than or equal to the remainder of the requested resource for that VC or group of VCs, and

the sum of all the allocated BEs is less than or equal to the remaining resource capacity of the common medium uplink.

16. A system according to claim 13 wherein there are multiple uplinks and multiple downlinks controlled by the BoD for a single headend and the means for allocating dynamic resource in the BoD allocates the share of the remainder of the requested resource, referred to herein as the best effort resource, BE, for each VC or group of VCs, by maximising the sum of the natural logarithms of all the BEs, subject to the conditions that;

the BE allocated to each VC or group of VCs is less than or equal to the remainder of the requested resource for that VC or group of VCs, and

the sum of all the allocated BEs is less than or equal to the remaining resource capacity of the uplink, for each uplink, and

the sum of all the allocated BEs is less than or equal to the remaining resource capacity of the downlink, for each downlink.

17. A system according to claim 1 which has an allocation table setting out resource allocation on the common medium access uplink wherein the allocation table is controlled by the means for allocating static resource in the CAC when static resource is allocated and is controlled by the means for allocating dynamic resource in the BoD when dynamic resource is allocated.

18. A system according to claim 1 which has an allocation table setting out resource allocation on the common medium access uplink which

allocation table is controlled by the means for allocating static resource in the CAC when static resource is allocated and is controlled by the means for allocating dynamic resource in the BoD when dynamic resource is allocated wherein the means for allocating static resource and for booking dynamic resource in the CAC periodically allocates resource and books resource in the table and forwards the table to the BoD for the means for allocating dynamic resource in the BoD to allocate dynamic resource in the table.

19. A system according to claim 1 wherein the means for allocating static resource in the CAC and the means for allocating dynamic resource in the BoD are constrained to allocate resource in such a way that traffic on the common medium access uplink is shaped by the integrated CAC and BoD resource allocation system.

20. An integrated connection admission control (CAC) and bandwidth on demand control (BoD) system for allocating the resource of a common medium uplink of a multiple access (MA) asynchronous network segment, wherein the CAC comprises means for allocating static resource and means for booking dynamic resource and the BoD comprises means for allocating dynamic resource and the system comprises an allocation table setting out resource allocation on the common medium access uplink which is controlled by the CAC when allocating static resource and booking dynamic resource and is controlled by the BoD when allocating dynamic resource.

21. A system according to claim 20 wherein the means for allocating static resource and booking dynamic resource in the CAC periodically allocates resource and books resource in the table and forwards the table to the BoD for the means for allocating dynamic resource in the BoD to allocate dynamic resource in the table.

22. An integrated connection admission control (CAC) and bandwidth on demand control (BoD) system for allocating the resource of a common medium uplink of a multiple access (MA) asynchronous network segment, wherein the CAC and BoD each comprise means for allocating resource which are constrained to allocate resource in such a way that traffic on the common medium access uplink is shaped by the integrated CAC and BoD resource allocation system.

23. A method of integrating a connection admission control (CAC) and a bandwidth on demand control (BoD) for allocating the resource of a common medium uplink of a multiple access (MA) asynchronous network segment, comprising the steps of:

the CAC allocating static resource to all virtual connections (VCs) accepted by the CAC on a per VC or per grouping of VCs basis,

the CAC booking dynamic resource to the VCs that require guaranteed dynamic resource on a per VC or per group of VCs basis and,

the BoD allocating dynamic resource to VCs or to groupings of VCs requesting dynamic resource in such a way that all VCs or groupings of VCs requesting dynamic resource are dynamically allocated requested dynamic resource up to at least the guaranteed dynamic resource which has been booked for them by the CAC.

24. A method according to claim 23 in which the CAC allocates static resource to a VC when a VC is set up for the duration of the connection associated with the VC.

25. A method according to claim 23 in which the CAC reserves booked dynamic resource to a VC when a VC is set up for the duration of the connection associated with the VC.

26. A method according to claim 23 wherein the groupings of VCs are within the same subscriber access unit (SAU) or terminal.

27. A method according to claim 23 wherein the CAC allocates static resource to a group of VCs and changes the amount of static resource allocated to a group of VCs when new connections are set up or connections are released within the group.

28. A method according to claim 23 wherein the CAC books dynamic resource to a group of VCs and changes the amount of booked resource allocated to a group of VCs when hew connections are set up or connections are released within the group.

29. A method according to claim 23 in which the CAC accepts a VC j requiring a static resource of $SR_j$ and a booked dynamic resource of $BR_j$ only if;

$$SR_j + BR_j + \sum_{k=1}^{K} SR_k + \sum_{k=1}^{K} BR_k \leq C_T$$

where $C_T$ is the total resource capacity of the common medium uplink and there are K existing VCs using the uplink and each of the K VCs have been reserved static resource $SR_k$ and booked dynamic resource $BR_k$ by the CAC.

30. A method according to claim 23 wherein the CAC comprises means for accepting a VC j requiring a static resource of $SR_j$ and a booked resource of $BR_j$ when;

$$SR_j + BR_j + \sum_{k=1}^{m} SR_k + \sum_{k=1}^{m} BR_k \leq C_{SAU}$$

where $C_{SAU}$ is the maximum rate available to an subscriber access unit (SAU) or terminal and there are m existing VCs (VC k for k=1,..., m) in the SAU or terminal and each VC k has static resource $SR_k$ and booked dynamic resource $BR_k$ reserved to them by the CAC.

31. A method according to claim 23 in which the CAC allocates static resource and the BoD allocates dynamic resource on a periodic basis.

32. A method according to claim 23 in which the CAC allocates static resource and the BoD allocates dynamic resource on a periodic basis and wherein during a current period the CAC allocates resource for new VCs and de-allocates resource from released VCs for the next period and the BoD allocates dynamic resource for the next period to VCs or groups of VCs requesting dynamic resource for the next period.

33. A method according to claim 23 in which the CAC allocates static resource and the BoD allocates dynamic resource on a periodic basis and in which during a current period the CAC allocates resource for new VCs and de-allocates resource from released VCs for the next period and the BoD allocates dynamic resource for the next period to VCs or groups of VCs requesting dynamic resource for the next period wherein the allocations made by the BoD for the next period are independent of the allocations made by the BoD for the current period.

34. A method according to claim 23 in which the CAC allocates static resource and the BoD allocates dynamic resource on a periodic basis and in which during a current period the CAC allocates resource for new VCs and de-allocates resource from released VCs for the next period and the BoD allocates dynamic resource for the next period to VCs or groups of VCs requesting dynamic resource for the next period wherein

the allocations made by the BoD for the next period are dependent on the allocations made by the BoD for the current period.

35. A method according to claim 23 in which the BoD allocates dynamic resource to VCs or groups of VCs according to the following rules;

when the requested resource from the VC or group of VCs is less than or equal to the booked dynamic resource for the VC or group of VCs, the BoD allocates the VC or group of VCs all of the requested resource, and

when the requested resource from the VC or group of VCs is greater than the booked dynamic resource for the VC or group of VCs, the BoD allocates the VC or group of VCs the booked dynamic resource and additionally the BoD allocates the VC or group of VCs a share of the remainder of the requested resource, from the remaining resource capacity of the common medium uplink.

36. A method according to claim 23 in which the BoD allocates dynamic resource to VCs or groups of VCs according to the following rules;

when the requested resource from the VC or group of VCs is less than or equal to the booked dynamic resource for the VC or group of VCs, the BoD allocates the VC or group of VCs all of the requested resource, and

when the requested resource from the VC or group of VCs is greater than the booked dynamic resource for the VC or group of VCs, the BoD allocates the VC or group of VCs the booked dynamic resource and additionally the BoD allocates the VC or group of VCs a share of the remainder of the requested resource, from the remaining resource capacity of the common medium uplink, and

in which the share of the remainder of the requested resource, herein referred to as the best effort resource, BE, for each VC or group of VCs, is allocated by maximising the sum of the natural logarithms of all the BEs, subject to the conditions that;

the BE allocated to each VC or group of VCs is less than or equal to the remainder of the requested resource for that VC or group of VCs, and

the sum of all the allocated BEs is less than or equal to the remaining resource capacity of the common medium uplink.

37. A method according to claim 23 in which the BoD allocates dynamic resource to VCs or groups of VCs according to the following rules;

when the requested resource from the VC or group of VCs is less than or equal to the booked dynamic resource for the VC or group of VCs, the BoD allocates the VC or group of VCs all of the requested resource, and

when the requested resource from the VC or group of VCs is greater than the booked dynamic resource for the VC or group of VCs, the BoD allocates the VC or group of VCs the booked dynamic resource and additionally the BoD allocates the VC or group of VCs a share of the remainder of the requested resource, from the remaining resource capacity of the common medium uplink, and

in which the share of the remainder of the requested resource, herein referred to as the best effort resource, BE, for each VC or group of VCs, is allocated by maximising the product of all the BEs, subject to the conditions that;

the BE allocated to each VC or group of VCs is less than or equal to the remainder of the requested resource for that VC or group of VCs, and

the sum of all the allocated BEs is less than or equal to the remaining resource capacity of the common medium uplink.

38. A method according to claim 23 in which there are multiple uplinks and multiple downlinks controlled by the BoD for a single headend in which the BoD allocates dynamic resource to VCs or groups of VCs according to the following rules;

when the requested resource from the VC or group of VCs is less than or equal to the booked dynamic resource for the VC or group of VCs, the BoD allocates the VC or group of VCs all of the requested resource,

when the requested resource from the VC or group of VCs is greater than the booked dynamic resource for the VC or group of VCs, the BoD allocates the VC or group of VCs the booked dynamic resource and additionally the BoD allocates the VC or group of VCs a share of the remainder of the requested resource, from the remaining resource capacity of the common medium uplink, and

in which the share of the remainder of the requested resource, herein referred to as best effort resource, BE, for each VC or group of VCs, is allocated by maximising the sum of the natural logarithms of all the BEs or by maximising the product of all the BEs, subject to the following conditions;

the BE allocated to each VC or group of VCs is less than or equal to the remainder of the requested resource for that VC or group of VCs, and

the sum of all the allocated BEs is less than or equal to the remaining resource capacity of the uplink, for each uplink, and

the sum of all the allocated BEs is less than or equal to the remaining resource capacity of the downlink, for each downlink.

39. A method according to claim 23 in which an allocation table setting out resource allocation on the common medium access uplink is controlled by the CAC when the CAC is allocating static resource and

booking dynamic resource and is controlled by the BoD when the BoD is allocating dynamic resource.

40. A method according to claim 23 in which in which an allocation table setting out resource allocation on the common medium access uplink is controlled by the CAC when the CAC is allocating static resource and booking dynamic resource and is controlled by the BoD when the BoD is allocating dynamic resource wherein the CAC periodically allocates resource and books resource in the table and forwards the table to the BoD to allocate dynamic resource in the table.

41. A method according to claim 23 wherein the CAC and BoD are constrained to allocate resource in such a way that traffic on the common medium access uplink is shaped by the integrated CAC and BoD resource allocation system.

42. A method of integrating a connection admission control (CAC) and a bandwidth on demand control (BoD) system for allocating the resource of a common medium uplink of a multiple access (MA) asynchronous network segment, which comprises the steps of the CAC allocating static resource and booking guaranteed dynamic resource and the BoD allocating dynamic resource and additionally comprising the steps of filling out an allocation table setting out resource allocation on the common medium access uplink in such a way that the table is controlled by the CAC when allocating static resource and booking dynamic resource and is controlled by the BoD when allocating dynamic resource.

43. A method according to claim 42 in which the CAC periodically allocates resource and books resource in the table and forwards the table to the BoD to allocate dynamic resource in the table.

44. A method of integrating a connection admission control (CAC) and a bandwidth on demand control (BoD) system for allocating the resource of a common medium uplink of a multiple access (MA) asynchronous network segment, in which the CAC and BoD are constrained to allocate resource in such a way that traffic on the common medium access uplink is shaped by the integrated CAC and BoD resource allocation system.